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Sheet feeding apparatus

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CLAIMS

1. Article feeding apparatus of the type in which flat articles such as sheets move downstream along an article flow path, including a prompter for moving articles along the flow path, wherein the prompter includes:
  - a shaft extending transversely to the flow path;
  - a first roller mounted on the shaft;
  - a body, including a first end and second end lying along the body length, the first end being pivotably engaged with the shaft proximate the first roller;
  - a second roller mounted at the second end of the body;
  - a belt mounted on and endlessly extending around the first and second rollers, including a surface operable frictionally to engage and move downstream articles along the flow path when the body second end is positioned upstream of the first end;
  - means for moving the belt around the rollers and thus rotating the rollers; and
  - means for imparting to the body a first moment created by a rotary friction force applied to the body; wherein the first moment urges the body to rotate around the shaft and thereby press at the second roller end against any article lying along the flow path.
2. Apparatus as in claim 1, wherein the means for moving the belt is operable to drive the first roller by rotating the shaft; the body including a first end which is bifurcated to straddle the first roller and frictionally engage the rotating shaft, thereby to create said first moment.
3. Apparatus as in claim 2, including a belt made of elastomer and stretched

between the rollers, so tension of the belt holds the body in frictional and pivotable engagement with the shaft.

4. Apparatus as in claim 2, wherein frictional engagement of the belt with an article resistant to motion imparts to the body, in the same direction as the first moment, a second moment proportional to the resistance of the article to motion along the flow path.
5. Apparatus as in claim 1, wherein the article flow path lies along a plane; wherein sheets are drawn from a stack lying on said plane; the prompter second roller lying above the stack at an elevation higher than the elevation of the first roller relative to said plane; wherein the height of the stack relative to the plane decreases from a first elevation to a second elevation, when sheets are moved downstream by the prompter.
6. Apparatus as in claim 1, including a belt with a surface comprising a plurality of transverse ribs with cross-sections which make the ribs substantially deflectable when the belt pulls an article along the flow path.
7. Apparatus as in claim 7, including a rib height to width aspect ratio of the rib cross-section of between about 1.3 and 2.6:1 for a rectangular-shaped rib and of between about 2 and 4:1 for a triangular cross section rib.
8. Apparatus as in claim 1, including a second prompter having a first roller, body, second roller, belt, and associated means for imparting a first moment to the body thereof, similar to those of the first prompter; wherein the second roller of the first prompter includes an axle shaft which rotates when said second roller rotates; and, wherein the first roller of the second prompter is mounted on and rotatably driven by said axle shaft.
9. Apparatus as in claim 1, comprising a singulator including a driver and a retarder, wherein articles are movable by the prompter along the flow path towards the singulator;

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wherein said prompter belt at the first roller comprises said singulator driver; the prompter belt including a surface with a groove running along its centerline; and wherein the retarder is positioned to fit within the groove of the belt.

10. Apparatus as in claim 1, including a first device positioned downstream from the prompter second end to receive, frictionally engage, and to move downstream articles delivered to the device path by the prompter; the first device being operable to move articles downstream faster than does the prompter belt; and the means for moving the prompter belt comprising an overrunning clutch engaged with the first roller, such that an article frictionally engaged simultaneously with the prompter belt and the first device is moved faster than is dictated by the means for moving the prompter belt, while still being substantially frictionally engaged with said belt.

11. Apparatus as in claim 10, wherein the means for moving the prompter belt is operable to rotate said shaft in combination with said overrunning clutch and the first roller; wherein said first device comprises a singulator including a driver mounted on and rotated by said shaft; the driver including an outside diameter larger than the outside diameter of the belt at the first roller.

12. Apparatus as in claim 10, including opposing mounting blocks slidably and detachably mounted on the apparatus;

the shaft being journaled at opposing ends in the mounting blocks;

each block being slidable along a plane transverse to the length of the shaft to enable adjustment thereof; and

resilient means for keeping the mounting blocks connected to the apparatus during use.

13. Article feeding apparatus of the type in which flat articles such as sheets are moved downstream along an article flow path and through a singulator nip having a

singulator nip gap spacing, comprising;

(a) a prompter for moving articles along the flow path, which prompter comprises:  
a shaft extending transversely to the flow path;

a first roller mounted on the shaft;

a body, including a first end and second end lying along the body length;  
the first end being pivotably engaged with the shaft proximate the first roller;

a second roller mounted at the second end of the body;

a belt mounted on and endlessly extending around the first and second rollers; including  
a surface operable frictionally to engage and move downstream articles along the flow  
path when the body second end is positioned upstream of the first end;

means for moving the belt around the rollers, thereby to rotate the rollers;

means for imparting to the body a first moment created by a rotary friction force applied  
to the body; wherein the first moment urges the body to rotate around the shaft and  
thereby press at the second roller end against any article lying along the flow path.

(b) a singulator including:

a driver for moving articles downstream through the nip by rotation in a first direction;

a dancer positioned in close proximity to the driver, to form the singulator nip;  
the dancer being movably mounted to enable a portion thereof to translate generally  
along the article flow path; and

means for resiliently biasing the dancer in the upstream flow path direction;

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wherein the gap spacing between the dancer and driver is changed by translation of said dancer portion in the downstream direction when an article passes through the nip.

14. Apparatus as in claim 13, wherein the dancer includes a body and a belt, movable in one direction only around the exterior of the body, for contacting articles in the nip and for contacting the driver in the absence of any article in the nip; wherein, when the direction of rotation of the driver is reversed, the driver frictionally engages said belt and causes said belt to move about the exterior of the body of the dancer in said one direction, thereby to expose a new portion of the belt in vicinity of the nip.

15. Apparatus as in claim 13, wherein the dancer is movable linearly; and wherein articles are movable along the flow path through the nip along a line of travel which is at an angle to the direction in which said dancer portion is movable.

16. Apparatus as in claim 13, wherein the articles are movable generally along a horizontal plane; the dancer being mounted to pivot in a vertical plane direction about a pivot point spaced apart from said dancer portion; the dancer portion being pivotable slightly in the vertical plane when an article passes through the nip, said downstream translation comprising a component of the slight pivoting motion.

17. Apparatus as in claim 16, wherein the dancer includes a belt mounted on rollers to provide a belt surface at the nip; and wherein pivoting of the dancer causes incremental movement of the belt on the rollers.

18. Apparatus as in claim 13, including:  
means for supporting a dancer body; the dancer body including a length lying along the flow path and opposing ends for receiving rollers, the dancer being movably mounted for linear motion on said means for supporting a dancer;

rollers pivotably mounted at opposing ends of the dancer body;

an endless belt stretched over the rollers and around the body, wherein a portion of the surface of the belt contacts articles at the nip, the belt surface portion being movable in the upstream direction only.

19. Apparatus as in claim 1, wherein the prompter is operable to move articles downstream at a first linear speed; the apparatus comprising a second assembly configured to take away articles from the prompter at a second linear speed greater than the first linear speed; the second assembly including at least one second assembly feed roller with a high friction surface for engaging articles; wherein, an article can be simultaneously frictionally engaged by said second assembly roller and said prompter as it moves along the flow path; said second assembly roller being coupled to a rotating motor to form a combination of motor and roller having a first rotational speed, the second assembly roller thereby being operable to impart to an article said desired second linear speed; said combination of motor and roller providing a polar moment of inertia sufficiently low such that, when said second assembly roller frictionally engages said simultaneously engaged article, the rotational speed of said combination sharply and substantially decreases to a second rotational speed, thereby to provide the second assembly roller with a second surface speed nominally matching said article first linear speed, so the second assembly roller exerts on the article a downstream force insufficient to overcome frictional engagement of the article with the first assembly.

20. Article feeding apparatus of the type in which flat articles such as sheets moved downstream along an article flow path, having a device called a prompter, for moving articles along the flow path, wherein the prompter includes:

- a shaft, running transversely to the flow path;
- a first roller, mounted on the shaft;
- a body, having a first end and second end lying along the body length; the first end pivotably engaged with the shaft proximate the first roller;
- a second roller, mounted at the end of the body, having an axle extending from each opposing end thereof;
- a belt, mounted and endlessly running around the first and second rollers;

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means for moving the belt around the rollers and thus rotating the rollers;

means for imparting to the body a first moment created by a rotary friction force applied to the body; wherein the first moment urges the body to rotate around the shaft and thereby press at the second roller end against any article lying along the flow path; and

a pair of wheels, for frictionally engaging and moving articles downstream, fastened to said axle at opposing ends of the second roller, each wheel having an outside diameter greater than the outside diameter of the belt where it runs around the second roller.

21. Article feeding apparatus substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.





## CERTIFICATE OF GRANT OF PATENT

In accordance with Section 24(2) of the Patents Act, 1977, it is hereby certified that a patent having the specification No 2319767 has been granted to Documotion Inc, in respect of an invention disclosed in an application for that patent having a date of filing of 1 April 1997 being an invention for "Sheet feeding apparatus"

Dated this Fourteenth day of February 2001

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